REPORT DOCUMENTATION PAGE			*Form Approved* *OMB No. 0704-0188*
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate only, other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (07804-0188), Washington, DC 20503.			
1. AGENCY USE ONLY *(LEAVE BLANK)*	2. REPORT DATE 4 August 1999		3. REPORT TYPE AND DATES COVERED Professional Paper
4. TITLE AND SUBTITLE V-22 Operational Testing: Immersion of V-22 Aircraft into Simulated Threat Environment			5. FUNDING NUMBERS
6. AUTHOR(S) Lynn Michelletti, Lynn Hellbaum, Huntt, Steve Ashburn			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Air Warfare Center Aircraft Division 22347 Cedar Point Road, Unit #6 Patuxent River, Maryland 20670-1161			8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Naval Air Systems Command 47123 Buse Road, Unit IPT Patuxent River, Maryland 20670-1547			10. SPONSORING/MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE
13. ABSTRACT *(Maximum 200 words)*			
14. SUBJECT TERMS V-22 Installed System Test Facility (ISTF) Modeling and simulation (M&S)			15. NUMBER OF PAGES 9 16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

13. ABSTRACT *(Maximum 200 words)*

This paper describes Air Combat Environmental Test and Evaluation Facility's (ACETEF's) role as the M&S/ISTF tool in the support of the V-22 OT-IID testing and how ACETEF incorporated the HPC to meet operational test requirements. More specifically, it describes the scope of the test, the test requirements, what resources were used, and how various system capabilities were provided. It also identifies improvements for future testing based on the knowledge and experience gained in this exercise. The ongoing V-22 OT-IIE Operational Evaluation (OPEVAL) test event, lessons learned, and risk issues will be discussed.

V-22 Operational Testing:
Immersion of V-22 Aircraft into Simulated Threat Environment

Prepared for:

International Test and Evaluation Association

High Performance Computing Workshop

June 28-July 1, 1999
Edgewood, Maryland

Lynn Michelletti, Simulation Engineer, J. F. Taylor, Inc.
MichellettML@navair.navy.mil, (301) 757-0765

Lynn Hellbaum Huntt, Electronics Engineer
HunttLH@navair.navy.mil, (301) 757-0747

Steve Ashburn, Electrical Engineer
AshburnSL@navair.navy.mil, (301) 757-0782

Air Combat Environment Test and Evaluation Facility
Manned Flight Simulator
NAWCAD (Naval Air Warfare Center Aircraft Division)
Building 2035
48182 Standley Rd Unit 5
Patuxent River, MD 20670-1909
(301) 342-7607 (Fax)

V-22 Operational Testing:
Immersion of V-22 Aircraft into Simulated Threat Environment

INTRODUCTION

In July 1998, the V-22 Multi-Service Operational Test Team (MOTT) expressed an interest in exploring the use of the Air Combat Environmental Test and Evaluation Facility (ACETEF) during the extensive OT-IIE V-22 testing phase planned for September 1999. ACETEF was requested to supply a simulated environment to test the aircraft and its crew's ability to carry out an operational mission, including stimulation of the aircraft's Electronic Warfare (EW) suite. ACETEF, located at the Naval Air Warfare Center Aircraft Division (NAWCAD), Patuxent River, MD, consists of several integrated laboratories designed to create simulated warfare environments during installed systems testing. In order to reduce the risk of the OT-IIE test event, the MOTT, Major John Torres V-22 Operational Test Director (OTD), included ACETEF for generation of a basic, yet functional simulated environment for the OT-IID testing. This test included ACETEF's modeling and simulation (M&S) and installed systems test capabilities as a proof of concept for V-22 operational test efforts.

This paper describes ACETEF's role as the M&S/Installed System Test Facility (ISTF) tool in the support of the V-22 OT-IID testing and how ACETEF incorporated the HPC to meet operational test requirements. More specifically, it describes the scope of the test, the test requirements, what resources were used, and how various system capabilities were provided. It also identifies improvements for future testing based on the knowledge and experience gained in this exercise. The ongoing V-22 OT-IIE Operational Evaluation (OPEVAL) test event, lessons learned, and risk issues will be discussed.

BACKGROUND

The V-22 program has long employed the techniques outlined in Simulation Test and Evaluation Process (STEP) by investing in a high fidelity simulator and cockpit at the Manned Flight Simulator (MFS). MFS is one of various integrated laboratories resident at ACETEF. Since 1986, under the direction of the V-22 program office (PMA-275), and with the assistance of Bell and Boeing, MFS built, developed, and continues to maintain a high fidelity V-22 simulator. The simulator development effort has historically been closely tied to the Integrated Test Team (ITT), resolving aircraft development issues and discovering discrepancies that would have otherwise been identified during flight test at great cost to budget and schedule. With the onset of the engineering and manufacturing development (EMD) phase, MFS has expanded its role beyond flight characteristics and into the total support of both the MOTT and ITT. The V-22 EMD simulator was completed prior to the first flight of the V-22 aircraft, providing the opportunity to perform extensive avionics system testing, flight test support and pilot training. The simulator incorporates avionics and aerodynamic modeling capabilities obtained from flight data and pilot feedback. This development process paralleled the aircraft test methodology preparation by the MOTT. Thus, when the MOTT was ready to test, the M&S tools were uniquely poised and positioned to support the testing.

1998 SCOPE OF TEST

The purpose of the 1998 OT-IID test was to evaluate both aircraft and pilot ability to perform a tactical recovery of aircraft and personnel (TRAP) mission. Hence, the test incorporated three goals. The primary goal was to measure the crew's capacity to plan and execute a mission, as well as evaluate their use of the aircraft's capabilities. The secondary goal was to evaluate the aircraft's capability to perform within its intended flight envelope and also its ability to present to the crew the required information, including threat data. Finally, the tertiary objective was to demonstrate ACETEF's ability to provide an adequate test environment and record relevant test data.

In order to satisfy these goals, the MOTT devised a test scenario to replicate operational conditions. In this case, the mission was a TRAP in a medium to high threat environment. Following normal operational conditions, pilots were provided a mission, geographic data and intelligence information, then required to develop a mission plan for recovering the airman. The crew's mission was to depart from an amphibious ship with a wingman, ingress, recover the airman, egress, and return to the ship. Along the way, the crew was to contact and coordinate with pre-positioned air support ready to assist in the recovery by engaging

threats. Missions were accomplished in both day and night conditions for realism. The threats consisted entirely of ground systems placed strategically throughout the test area. The threat environment was based on a China Lake threat lay down. To accomplish this, V-22 Aircraft No. 10 was rolled into ACETEF's shielded hanger and the aircraft's EW sensors were stimulated. The simulator in MFS was linked to the EW system output for pilot information and the entire scenario was linked through a virtual warfare environment, providing for a closed loop, hardware in the loop test with a V-22 TRAP mission scenario.

RESOURCES

The M&S resources required to provide an aircraft-in-the-loop, man-in-the-loop simulated warfare environment are complex in nature. Figure 1 represents the ACETEF laboratories and pictorially describes their interface with each other. As shown, the Warfare Simulation Team (WFST), through Simulated Warfare Environment Generator (SWEG), obtained data from the other laboratories for the purpose of data collection, data analysis, and critical information exchange between facilities. The Simulation Support Team (SST) linked all of the laboratories together for the purpose of relaying video and audio signals. The Electronic Combat Stimulation Team (ECST) provided the aircraft with RF, UV and Laser stimulation from threat data supplied by SWEG and the WFST. MFS provided the man-in-the-loop portion of the test with out-the-window visuals and the V-22 cockpit environment. The ACETEF simulation and stimulation resources used to accomplish this OT-IID test are described in more detail below.

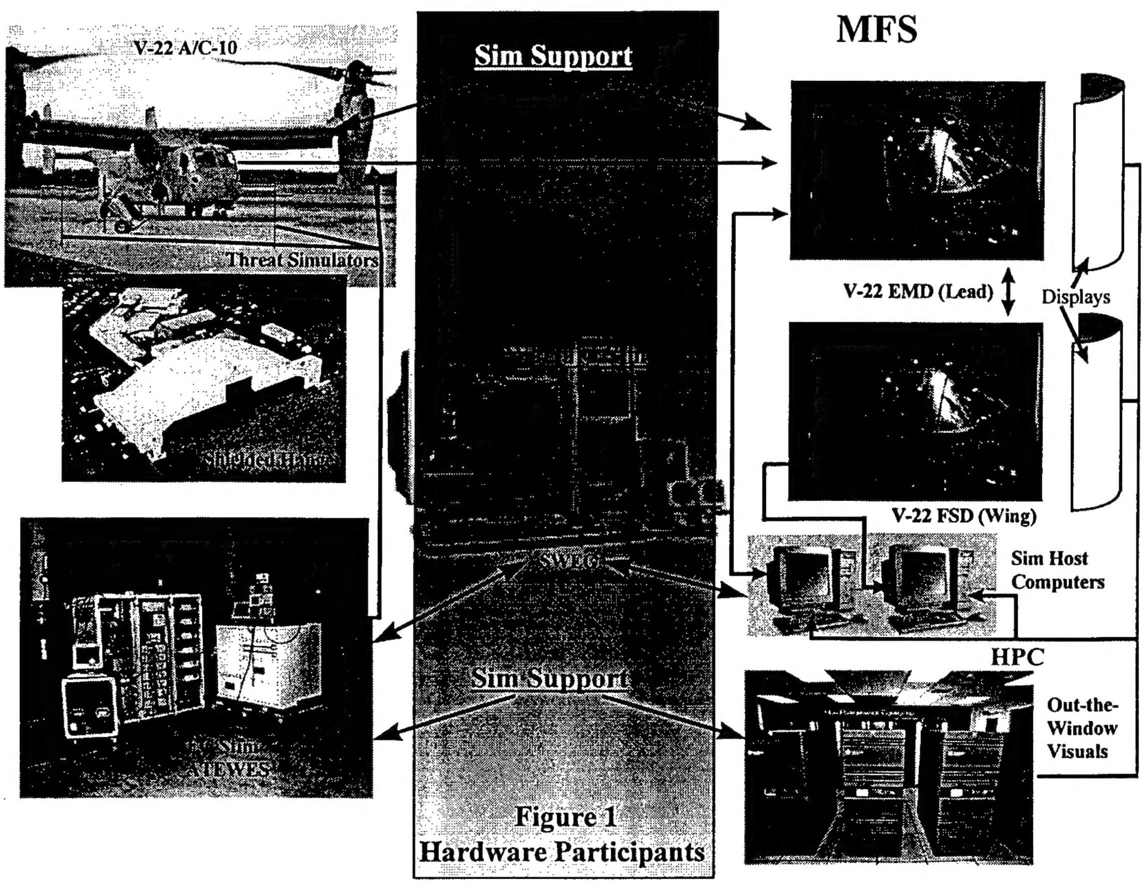

Figure 1
Hardware Participants

V-22 Operational Testing:
Immersion of V-22 Aircraft into Simulated Threat Environment

ACETEF

The ACETEF is a fully integrated ground test facility developed to support multi-spectral test and evaluation of aircraft and aircraft systems in a secure and controlled environment. ACETEF consists of four simulation/stimulation teams which, when integrated under the ACETEF concept, provide a critical tool in the assessment of embedded system performance, integrated system performance, and mission effectiveness of naval aviation weapons systems.

The ACETEF concept is a full environment stimulation of the aircraft and pilot and is centered around the Anechoic Chamber. For large scale Installed Systems Test (IST) within this chamber, an aircraft can operate its actual sensor systems, be stimulated by the laboratories, and be electronically linked to the other laboratories to simulate an entire airborne environment, all in a secure, repeatable environment. A new larger Anechoic Chamber was dedicated in June 1999 and is now operational. The new chamber allows the same secure, repeatable testing, but for larger aircraft or for multiple tactical aircraft (e.g., a strike package).

Linked into this chamber are various laboratories located at ACETEF, which provide a complete environment. These laboratories are grouped into four teams as follows WFST ECST, SST, and the Aircraft Simulation Team (ACST) or MFS.

Warfare Simulation Team

The WFST consists of the Operations and Control Center and the Warfare Simulation Laboratory. Through the use of the SWEG, the WFST provides the capability to develop script files, containing the threat type and location, describing a tactical theater, providing complete immersion of the platform into a scenario. SWEG emulates command and control of the systems that the crew would see in the real world.

Electronic Combat Stimulation Team

The ECST consists of the Electronic Warfare Integrated Systems Test Laboratory (EWISTL), the Threat Air Defense Laboratory (TADL), the Offensive Sensors Laboratory (OSL), and the Communication, Navigation, Identification (CNI) Laboratory. The ECST provides the real-world stimulation to the aircraft in the form of RF, UV and Laser signals, as well as Global Positioning System (GPS) satellite simulation. The ECST provides dynamic high-fidelity signal environments and stimulated various sensor systems on Aircraft No. 10 during the test.

Simulation Support Team

The SST provides instrumentation and network support to the laboratories and maintains the High Performance Computer (HPC) used by the other laboratories. The HPC ran the visual system executable and the SWEG interface during the test period. The SST provides integration with the aircraft and systems under test. It links the laboratories together with the required interfaces and records data residing in the interfaces.

Aircraft Simulation Team

MFS includes a wide range of simulation stations that support its high fidelity flight dynamic and avionics system simulators. These include a synergistic six degree of freedom motion capable station, a fixed base 360 degree field-of-view dome simulation station, two engineering development stations, and a low-fidelity, low-cost simulation station with the capability to support higher levels of security. The M2DART, a new, higher fidelity visual display system, will be added to the lab in August 1999. The High Level Architecture (HLA) and Distributed Interactive Simulation (DIS) protocols enable multiple simulation stations, covering the spectrum of air-to-air, air-to-ground, combat, formation and training scenarios, to interact with one another and with simulation facilities around the world. The man-in-the-loop simulation stations within MFS can also be linked together in an interactive virtual environment. The six high-fidelity and other mini cockpits at MFS were all constructed in-house to meet the laboratory standard interface necessary for operation in the simulation stations. The cockpits are installed on a standard baseframe for

mobility throughout the facility and to accommodate the Roll In/Roll Out (RIRO) design utilized in the simulation stations.

TEST COMPONENTS

Figure 2 depicts the threat scenario and what role each piece played in the TRAP mission. Each virtual participant was controlled by SWEG and integrated within the visual system. The scenario "players" are interactive within SWEG as they are driven by the V-22 EMD aircraft position.

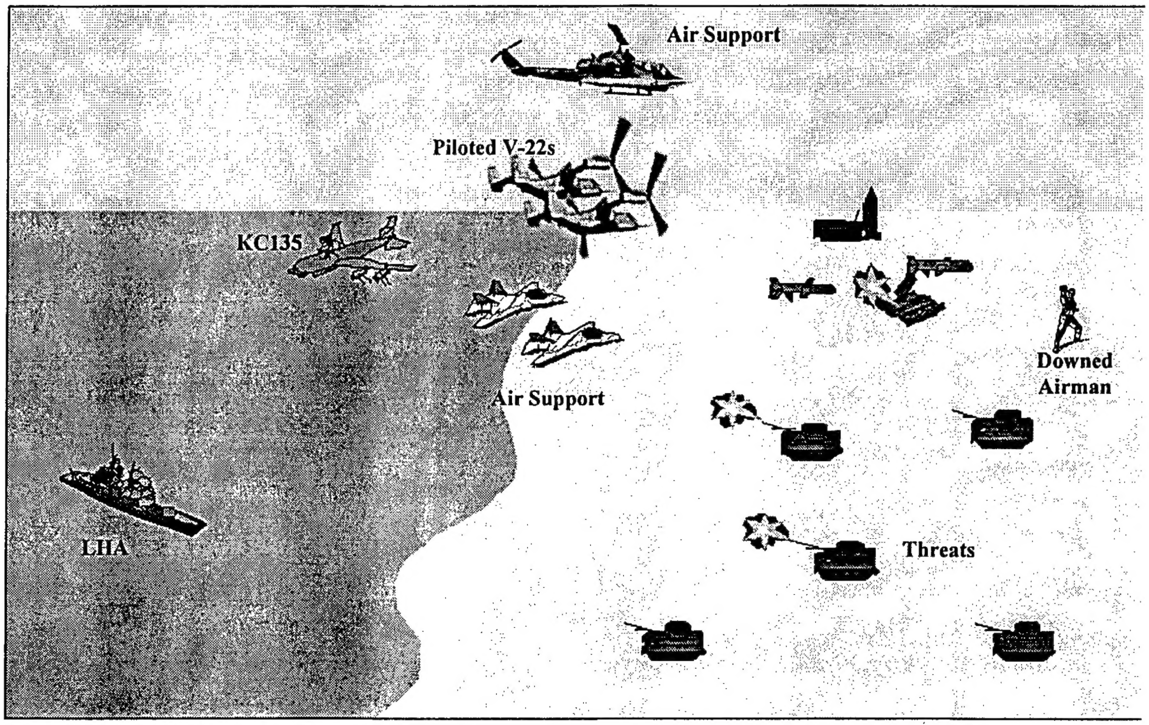

Figure 2
Software Participants

<u>Hardware</u>

- **V-22 Aircraft No. 10:** The aircraft was placed in the ACETEF shielded hangar where its EW sensors were stimulated by the ECST. The EW suite includes the IP-1150 threat display, the APR-39 radar-warning receiver, the AAR-47 missile-warning receiver, the AVR-2 laser warning receiver, and the ALE-47 countermeasures dispensing system.
- **V-22 EMD Simulator:** The MFS V-22 EMD simulator is built around high-fidelity aerodynamic and flight control models. Its avionics are a combination of both actual and simulated hardware including an Advanced Mission Computer (AMC), Display Electronics Unit (DEU), Multi-Function Displays (MFD), Engine Instruments Caution and Advisory Summary (EICAS) Display, Control Display Units (CDU), Flight Director Panel (FDP), Digital Map (Dig. Map), and Night Vision Goggle/Heads Up Display (NVG/HUD). The EMD cockpit was piloted by the test subjects and served as lead aircraft.
- **V-22 FSD Simulator:** Formally the MFS V-22 FSD simulator, it is now stripped of all panels and avionics. The cockpit maintains controls and displays to support a single V-22 pilot. The cockpit flew as wingman; however, it served solely as an observer and could not be attacked by threats. The cockpit was piloted by one of the two test coordinators.
- **Stimulation of APR-39 Radar Warning Receiver (RWR):** Using the Advanced Tactical Electronic Warfare Environment Generator (ATEWES) stimulator from the EWISTL, the V-22 APR-39 RWR

was stimulated via free-space radiation of signals representing actual threat emitters in a medium/high threat environment. The threat environment was controlled by SWEG, which cues the ATEWES RF generation based on V-22 flight profiles. The four (2-18Ghz) quadrant and one low band (.5-2Ghz) antennas were stimulated. The ATEWES signals were fed through external amplifiers and then to standard gain horns mounted not more than 0.5 inches from the APR-39 spiral antennas.

- **Stimulation of AAR-47 Missile Warning Receiver:** Using a hand-held prototype Ultraviolet (UV) stimulator provided by Georgia Tech Research Institute (GTRI), the V-22 AAR-47 Missile Warning Receiver was stimulated using manual cues from SWEG personnel based on the V-22 flight profile. During this test, UV stimulation was provided in the forward quadrants only. The GTRI UV Stimulator was positioned around the aircraft as required during the test. Placement of the device was on the ground, approximately 20 feet directly off the port or starboard side. A GTRI employee manually triggered the device.
- **Stimulation of the AVR-2 Laser Warning Receiver:** Using an in-house developed laser stimulator, the V-22 AVR-2 Laser Warning Receiver was stimulated using manual cues from SWEG personnel based on the V-22 flight profile. During this test, laser stimulation was provided in the forward quadrants only. Laser Stimulator #1 was positioned in the 45-degree quadrant, with Stimulator #2 in the 315-degree quadrant. Each laser was mounted approximately 10 feet from the sensor. Both lasers were mounted on tripods extended to full height (approximately 6 feet from the hangar deck).
- **High Performance Computing (HPC) Center:** The computers situated at ACETEF were used to generate out-the-window visuals and to run SWEG. The visual system is also capable of sensor simulation, such as FLIR. There have been two databases developed on the HPC for the OPEVAL. The one used in the 1998 test was for the China Lake area. The one currently planned for use in the 1999 test is the Generic Composite Scenario (GCS) database.

__Software__

- **Threat Environment:** The WFST developed custom threat environments based on each flight crew's flight plan. The WFST was also responsible for the development and upkeep of the SWEG application. SWEG controls the threat environment for all of the ACETEF laboratories linked to each other through a SCRAMNET ring. All critical data is passed between labs through the SWEG interface. The threat environment executable is run on the HPC. The threat environment includes all of the other 'players' in the scenario, all other aircraft, and personnel, as described below:
  - **LHA:**. The amphibious assault ship served as departure point for the test subjects and their wingman. The modeled ship was stationed (displayed in the visual database) off coast of the test range. This model was controlled by SWEG.
  - **KC-135 Tanker:** The aircraft served as a rendezvous point for test subjects and wingman off the coast of the test range. (Note: Actual refueling from the tanker was not within the scope of the test, however, it will be in future operational testing.) This model was controlled by SWEG.
  - **Air Support:** Support consisted of AH-1 Cobra helicopters and AV-8B Harriers. These entities were generated by the WFST and these models were controlled by SWEG.
  - **Downed Airman:** A computer generated person located in hostile territory. He signaled his position with smoke and flashing lights. The airman would run to V-22 crew when aircraft touched down within required distance. This model was controlled by SWEG.

__Integration__

- **Radar Warning Receiver:** The SST interfaced with the aircraft APR-39 video signal being sent to the cockpit's IP-1150 display – displaying the proper image on the IP-1150 display installed in the simulated cockpit. The SST tapped into the aircraft intercom system in order to obtain the voice warnings being sent from the APR-39 unit. These signals were then relayed to MFS where they were integrated into the V-22 EMD cockpit. The voice warnings were then provided in the simulated cockpit's intercom system.

1998 METHOD OF TEST

While the crews briefed their missions to the test coordinator, the V-22 EMD cockpit was installed in the motion base simulation station and the simulation software was executed as baselined for this test. The ACETEF checklists were followed, and a baseline scenario was flown to verify the integration. As the crew flew, their current position was passed through the transfer function to the SWEG interface. SWEG calculated the range and bearing of the aircraft to threats and prompted ATEWES to stimulate the EW suite sensors on Aircraft No. 10 when the aircraft was within range. The APR-39 on Aircraft No. 10 processed the threat information and alerted the pilot by sending threat alerts to the IP-1150 display and to the intercom system.

The pilot reacted to the threat by depressing countermeasure switches located on the thrust control levers (TCL). The crew's reaction was then passed to SWEG. The pilot's reaction was recorded as the type of countermeasures dispensed, the number of the countermeasures dispensed, and the time to dispense. SWEG then determined if there was a break lock by evaluating the type of countermeasures dispensed and the time to dispense the countermeasures. If SWEG determined that there was a break lock, then the crew saw the threat and a missile trail fly harmlessly off to the side or behind the aircraft. SWEG also prompted ATEWES to stop stimulating that aircraft sensor. If there was no break lock, then the crew saw an immense explosion off the nose of the cockpit, denoting a "hit". At that time, malfunctions were inserted into the simulation to indicate unit failures or degradations in aircraft equipment and performance.

When the aircraft approached the downed airman, SWEG prompted the HPC visual system to provide a smoke flare or a flash cue to mark the objective's location. The crew could then track this visual cue to a landing rescue of the objective.

1998 FOLLOW-ON FLIGHT TESTING

Electronic Warfare

Once the V-22 OT-IID testing was completed at ACETEF, Aircraft No. 10 was tested at MCAS Cherry Point and then Eglin AFB undergoing much of the same testing performed at ACETEF. In line with the STEP process, data from those tests was fed back to ACETEF in order to improve SWEG accuracy by integrating real probability of kill (P_K) information driving the functionality of the threats.

As the V-22 MOTT's confidence in the reliability and consistency of scenarios increases, testing will begin to expand the EW envelope of the modeling and simulation test, as well as the aircraft capabilities. The V-22 MOTT is committed to using simulation flights as rehearsal flights for operational testing flights, and desire to push the limits of EW testing by exercising systems that cannot be exercised during peacetime.

1998 LESSONS LEARNED

Test Method

As with any test evolution, the importance of a single/dedicated test engineer was reinforced during this particular test. In general, the test engineer could focus on the process, as opposed to the implementation, thereby ensuring proper procedure and quality data output. Initially his focus would be to clearly define test requirements and methods. Prior to the scenario, the test engineer could guarantee proper scenario implementation by focusing on validation and verification processes. Finally, during the test, he would assist the test coordinators in monitoring data collection and test subject progress.

Visual and Terrain Correlation

Many of the lessons learned during this test revolve around implementing an operational test for rotary wing aircraft. Unlike a fighter, which flies high and fast, a rotary aircraft flying "nap of the earth" is highly dependent on landmarks, geography, and ground details. The following describes the difficulties encountered in satisfying these requirements.

The pilots were concerned with the correlation of the digital map display located within the cockpit and the out-the-window terrain of the visual database. Often, the pilot would expect to see sharp cliffs, ridges, and valleys out the window based on his digital map display. Instead, he would be presented shallow and smooth transitions of terrain. Even though some of the mountainous features did show up, many were not available due in part to the limitations of the Level 1Digital Terrain Elevation Data (DTED) upon which the visual database is based. This results from the amount of data sampling performed in order to reduce the polygon count to a manageable load during creation of the database. A couple of solutions can remedy this. First, the rough locations of the planned pilot flight path must be pre-defined, so that the visual engineers can test the flight corridors and modify by hand or re-polygonize the terrain to enhance features that are smoothed over by the process of triangulation. Second, particular features that the pilots find most important must be identified so that test engineers can ensure that those features are available.

As well as the concern with correlation between the visual database and the terrain contours on the digital and paper maps of the area, there was also a correlation concern between SWEG terrain, the visual maps, and the visual database. One solution would be to implement a process using a well-defined terrain triangulation for generating SWEG terrain from DTED and, consequently, using that SWEG terrain as a basis for visual database terrain skin. Another solution is the use of a multi-spectral database (MSDB) of complexity requiring an HPC system to generate not only a visual scene, but also host a correlated SWEG database and FLIR imagery.

This solution of enhancing the SWEG and the visual database correlation would result in other benefits. For example, rotary players that currently seem too high in the visual scene would now appear at the appropriate altitude. Also, any ground players (threats, trucks, downed pilot, etc.) would not require visual ground clamping, thus speeding up the application. Finally, realistic missile engagement registration and correlation of visual and RF terrain masking could be improved.

Additional lessons learned included the benefits noted by the crews of being immersed into the simulated threat environment. For example, it was advantageous for the crew to see visual cues such as ground based threats and missile trails, supporting a more realistic threat environment. Additionally, the test coordinators found that the option of deciding which cockpit displays to record during the critical moments of testing was very beneficial for future analysis. Lastly, the test coordinators found it useful to have an overall, real-time view of the scenario generated from SWEG. This allowed test coordinators to have a "birds-eye" view during the execution of the exercise.

1999 METHOD OF TEST

ACETEF will once again be supporting the V-22 MOTT in their Operational Test efforts (the OT-IIE phase) in 1999. Planning for the use of M&S in ACETEF for OPEVAL began in February, 1999 and support will continue through October, 1999. The scenario for the 1999 test is also a TRAP mission, but the threat level is significantly higher than the 1998 test – aimed at performing more analysis related to mission success, vulnerability and pilot workload. The ACETEF effort is designed as a gradual 'spool-up' that involve three phases. The first phase of testing is a pure M&S of the V-22 EW suite. The second phase of testing involves stimulation of a hot bench containing the V-22's EW suite. The third phase of testing would involve using AC No.11's EW suite while the aircraft is installed in the shielded hangar. During the first two phases, the pilots will perform TRAP missions on a bi-weekly basis, while analysts collect data aiding in the determination of mission success, pilot workload and vulnerability. At the same time , the pilots will become familiar with the simulated cockpit, the EW suite, the scenario, and the visual system database. During the third phase of testing, the pilots will perform a modified TRAP scenario using the aircraft EW suite in order to evaluate the survivability of the aircraft. For added realism, the crews will be performing the OT-IIE exercises with the V-22 EMD cockpit under motion. As in the 1998 testing, some missions will be flown under night conditions; all sessions will employ the forward looking infrared imaging system, as well as the digital map system.

As learned in the 1998 test, correlation between the SWEG database, the visual system database, and paper and digital maps is crucial. This factor prompted the use of the GCS database for OT-IIE. The GCS database is a highly developed MSDB originally created for the Joint Strike Fighter (JSF) program. The threat lay down within the database is fictional and does not correlate to a specific country. The database was designed based on threats projected 10 years into the future. The terrain encompassing the threat lay down is a combination of plains, mountainous region, and desert. The target areas within the visual database have been highly developed and contain great detail. The extent of this database and the use of the FLIR necessitate the use of the HPC in order to maintain the update rates necessary for the operational virtual environment. HPC provides tremendous capability in the provision of a correlated MSDB for the OT-IIE scenarios.

Other upgrades from the 1998 testing are increased use of SWEG integration capabilities. Radar Cross-section (RCS) information, as well as IR, chaff and flare effectiveness information enhance the scenarios and the fidelity of the environment, aiding the test director in the determination of vulnerability and pilot workload. Automated lookup mechanisms will now determine the possibilities of hits and kills of the aircraft, and are linked to malfunction insertion capabilities for realistic response to weapon impact. A new feature due to the use of the motion capability at MFS will be a physical impact input to the simulation.

A new dimension has also been added this year in the requirement of a Commander, Operation Test and Evaluation Force (COTF) Accreditation of the M&S used in the testing. The ACETEF engineers are developing V&V plans for each M&S unit, as well as adequately providing documentation of the environment provided for test. This effort will have a tremendous impact for ACETEF as a whole, aiding in its acceptability for future operational testing.

SUMMARY

The development of M&S/ISTF tools in support of the acquisition process, as proscribed by STEP, can produce benefits as exemplified by the V-22 program. The V-22 simulator development effort at MFS has historically been closely tied to the DT, resolving aircraft development issues and discovering discrepancies in aerodynamic, flight controls and avionics systems that would have otherwise not been discovered until flight testing. As aircraft systems continue to grow more complex, simulation can be an effective tool to support OT, as well as other phases of the acquisition process. As shown in V22 OT-IID exercise, the assets developed during developmental testing, if done correctly, can easily be transitioned into an operational asset. ACETEF installed systems testing for the V-22 OT is an excellent STEP real-world application. Providing feedback throughout the aircraft development will improve both the end product and the M&S assets simultaneously.

Both 1998 and 1999 V-22 OPEVAL testing efforts have greatly enhanced HPC usage for virtual environment generation at ACETEF and continues to be a driving factor in providing high fidelity test environments. HPC is a tremendous asset in providing a correlated visual and threat database, as well as an invaluable tool in its capability of generating smooth and continuos out the window visuals.